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Revision of the Genus *Pandanus* Stickman. Part 42
Pandanus tectorius Parkins. ex Z and *Pandanus odoratissimus* L.f.[1]

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THE FOUNDATION OF THE GENUS *Pandanus* was made long ago. In 1679 Rheede van Draakestein published names, descriptions, and large, detailed illustrations of four species of western India. Then, in 1743, in his posthumous *Herbarium Amboinense*, Rumphius named, described, and illustrated 11 species, putting them in two genera, one of which he named *Pandanus*. Both of these works were pre-Linnaean, but they were written in the Indo-Pacific tropics, with living specimens at hand, and they presented far better treatments than did the early works by European botanists, subsequent to 1753.

There is a dispute as to the first valid publication of the genus *Pandanus*. The author has published his view (1963) that it was validly published in 1754 by Olaf Stickman, in his doctor's thesis, under Prof. Carolus Linnaeus. In it he bases the genus upon a reference to Rumphius, adopts the name *Pandanus*, and gives a generic description of a few words. No species were included, but none were obligatory.

Another view was shown by the vote of the Committee for Spermatophyta (Tenth International Botanical Congress 1964) not to adopt *Pandanus* L.f. (1781) as a *nomen conservandum*, the majority feeling that it was not needed and that Parkinson's description (1773) of *Pandanus* was valid. To this the writer has rebutted that Parkinson's *Pandanus-tectorius* was a monomial, hence invalid. If the committee's view that *Pandanus-tectorius* Parkinson is a valid binomial is accepted, it has no real significance, for the species is a *species dubia*. In the subsequent (1774) German edition of Parkinson (see St. John 1972), the binomial *Pandanus* (as *Pondanus*) *tectorius* was validly published by Parkinson ex Herr Z, an unidentified German. Actually, its holotype still exists in the British Museum (Natural History). It is a sheet of which the lower 4 to 5 inches was burnt off by a bomb-induced fire during World War II. In Solander's hand it is labeled "*Pandanus tectorius* mss., Society Islands, 1769, *Banks & Solander*." The sheet bears portions of two leaves, and a young pistillate inflorescence, burnt off at the base of the flowering part. There is no fruiting specimen from Cook's first voyage, or for that matter from either of his other two voyages. In Solander's field notes there are long descriptions of the staminate and the pistillate flowers, none of which now have any diagnostic value. For the fruit he said only, "*Baccae* aggregatae polyspermae."

Solander also left a completed manuscript, "Primitiae Florae Insularum Oceani Pacifici ...." for *Pandanus* this is largely identical with his field notes, but on page 351 he wrote, "Stigmate transversali lineari, adnato e quo ad seminis embryonem canalis descendit."

We now know numerous species of *Pandanus* with linear stigmas. They form the two sections *Acrostigma* and *Solmsia*, but none of them had been published at the time when Solander was making his studies. Hence, it is not obvious how he got the idea of linear stigmas. The only species of *Pandanus* found in Tahiti up to the present have stigmas that are cordate or reniform, as do all species of the section *Pandanus*. Consequently, Solander's statement that *P. tectorius* had linear stigmas, is considered erroneous. It was in Tahiti that Solander discovered and wrote a description of *P. tectorius*. The artist of the voyage, Sydney Parkinson, also made

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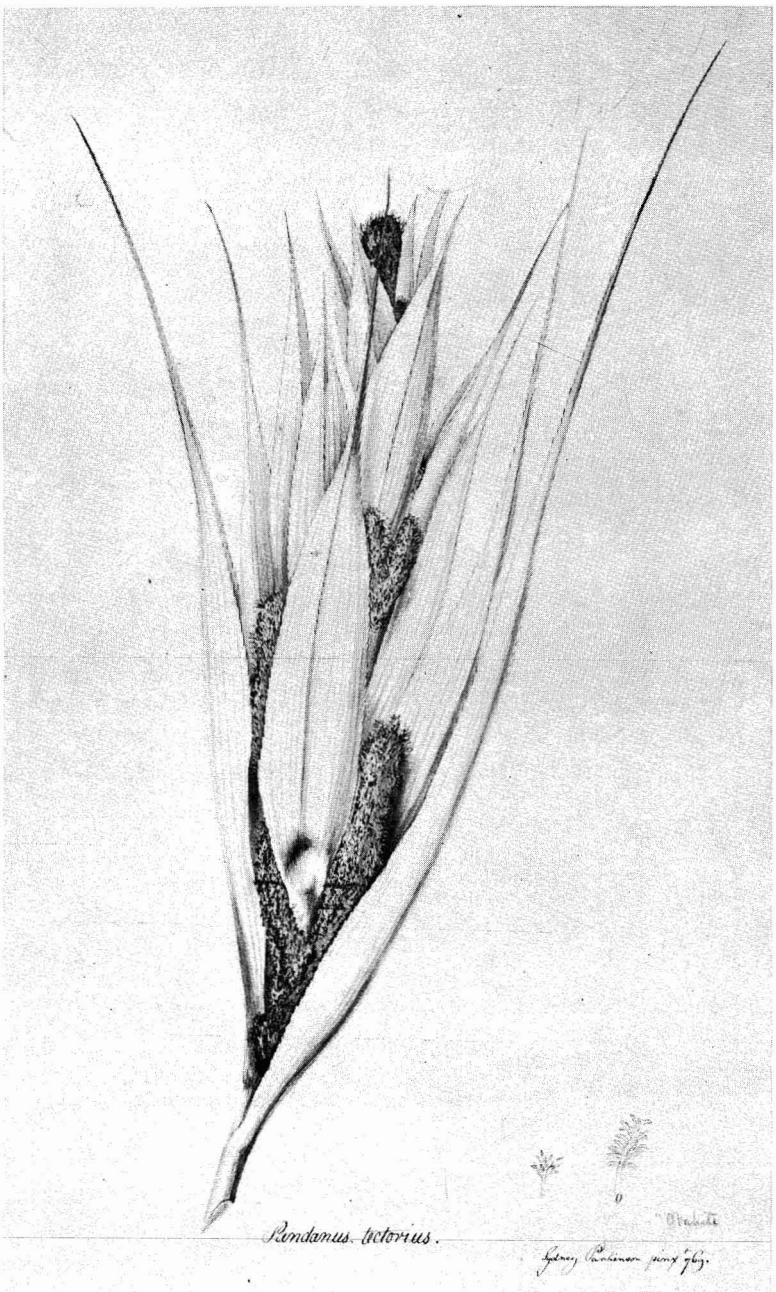

FIGURE 408. *Pandanus tectorius* Parkins. ex Z, Society Islands, 1769, *Banks & Solander*; illustration of the staminate plant by Sydney Parkinson (British Museum of Natural History).

a drawing of a staminate inflorescence (Figure 408), and a detail of two staminate fascicles of it, but he did not illustrate the pistillate plants.

Parkinson's published treatment was as follows:

"E awharra. *Pandanus-tectorius.*

"This tree generally grows on the sandy

hillocks by the sea-side, and is found in great plenty on all the low islands; the leaves are long, like those of sedge, sawed on the edge, the flowers are male and female, growing upon different trees, those of the male-flower small very sweet; and, of the bractea of them, which are white, they make a sort of garlands to put round their heads; the fruit is orange colour, and as big as one's head, consisting of congeries of small cones, like those of the Anana, or Pine-apple, which they much resemble; the bottom of these cones, sucked when full ripe, yield a flat insipid sweetness, and are eaten by the children; but the chief use of this tree is in the leaves, which, when plucked and dried, make excellent thatching for their houses, and various sorts of mats and baskets. This is the Palmetto of the eastern voyagers."

Nothing in the notes by Solander or in the publication by Parkinson is of any diagnostic specific value. It is clear that they were written about a species in the section *Pandanus*. If in Tahiti there was but a single species of this section, one could select a new standard specimen and thus reestablish the species *P. tectorius*. On the contrary, the genus *Pandanus* is quite prolific on Tahiti, there being seven known lowland species there, and several others as yet unpublished. These are quite well-known, but it is impossible to equate any of them with *P. tectorius*, which, though it is a valid species, must remain a *species dubia*. Stone (1967: 242), thinking that *P. tectorius* legally dated from 1900, states that another name must be found for the "species (singular or plural) of Tahiti." He states that the Hawaiian *P. Douglasii* Gaud. (1841) occurs in Tahiti and is an available name. The writer is aware of Stone's lumping of taxa with different morphology, from remote areas into a single unit. Having had Stone as a graduate student and assistant for 3 years, and having followed his studies and publications since then, the author has a good idea of the value of Stone's taxonomy. He can observe differences and resemblances, but his judgment and his conclusions are of a different order. Half the time the writer cannot agree with Stone's results, and particularly in large and complicated problems, can seldom agree with him. On the contrary, *P. Douglasii*, a Hawaiian species, is unknown in Tahiti, but a somewhat similar species found there is *P. dicheres* St. John.

Pandanus odoratissimus L.f., Suppl. Pl. 424–425, 1781, excluding the synonyms by Rheede, Rumphius, Forskal, and the Forsters; Stone, Ceylon J. Sci. (Bio. Sci.) 11(2):120, 1975.

NOM. VERN.: "woelhakejija" (by Hermann); "mudukéyiya," "moodoo-kaiyeya" (Singhalese, by Thwaites); "talai" (Tamil)

Figure 409

ORIGINAL DIAGNOSIS:

"DIOECIA

"MONANDRIA

"*odoratissimus*. PANDANUS.

Kaida. *Rheed. mal. v.* 2. *p.* 1. *t.* 1 *ad* 8.

Pandanus. *Rumph. amb. v.* 4. *p.* 139. *t.* 74 *ad* 81.

Bromelia foliis margine dorsoque aculeatis, caule fulcrato spinoso. *Flor. Zeyl. p.* 54.

Keyra. *Forsk. aegypt. p.* 172.

Athrodactylis spinosa. *Forst. gen. n.* 75.

Habitat in Zeylona. *Specimen siccum communicavit* Dr. Thunberg. ħ.

Colitur in Indiis ubique, usque ad Terras maxime orientales, sed solummodo mas, qui per ramulos plantatur, cum foeminae nullius usus.

Planta adhuc tenera acaulis est, ut Bromelia Ananas, cui tunc simillima, adultior caulescit & tandem Palmae instar arborescit, prolifice ramificatur, h. e. ubi florem producit ramos plures infra florescentiam radiatim emittit & sic ultra; ramulorum & caulis inferior part sensim foliis denudantur & laeves evadunt.

Folia in apice ramorum confluentia, trifariam imbricata, sessilia, amplexicaulia, basi lanceolata, canaliculata, erecta: apice longissimo, subulato dependente; tri-s. quadripedalia, nervosa, glabra, carina marginibus spinoso-serratis.

Inflorescentia masculina: Racemi compositi, thyrsiformes, in apice ramorum inter sup-

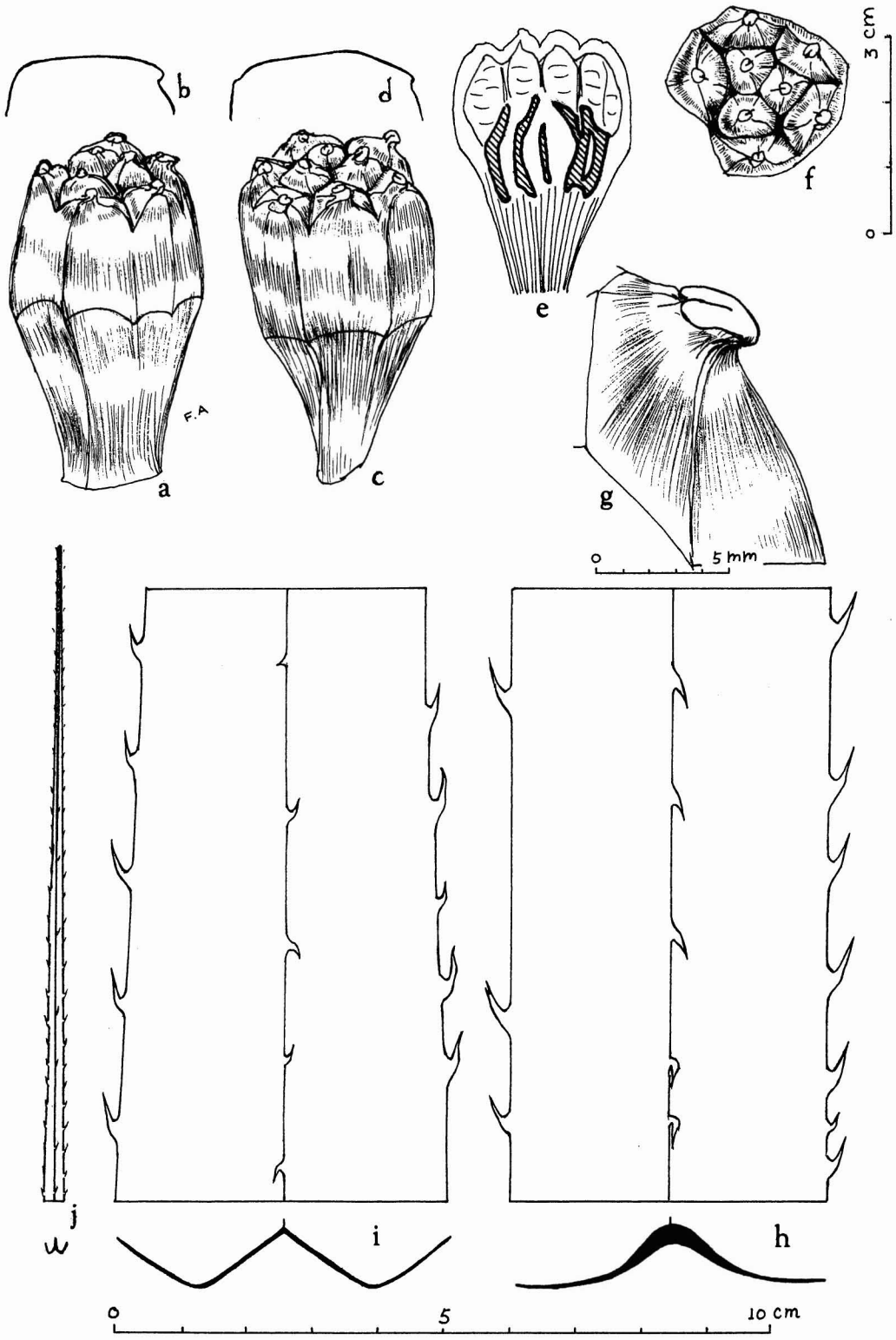

FIGURE 409. *Pandanus odoratissimus* L.f., from standard specimen, Ceylon, *St. John* 24,212. *a*, phalange, lateral view, ×1; *b*, its profile, ×1; *c*, phalange, lateral view, ×1; *d*, its profile, ×1; *e*, phalange, longitudinal median section, ×1; *f*, phalange, apical view, ×1; *g*, carpel apex and stigma, ×4; *h*, leaf base, lower side, ×1; *i*, leaf middle, lower side, ×1; *j*, leaf apex, lower side, ×1.

rema folia provenientes, in singula axilla solitarii, sessiles, breves, divisi in Amenta simplicia, approximata, brevissima, haec in Dentes breviores, patentes, Anthera lutea terminatos. Mira frutificatio cuius simile nescio; an Amentum nudum potius dicenda?

Inflorescentia foeminea: Spadix etiam terminalis, sed inter quatuor folia breviora, globosa.

Fructus magnitudine Bromeliae Ananatis, cum qua etiam folia conveniunt, sed pedunculo elongato nuntant.

Praestantissima arbor, odoris caussa colitur, quem spirat tam divitem, ut una alteraque spica satis sint ad replendum cubile spatiosum habitu odorifero per longum tempus, si loco humido reponatur ideoque incolae non curant orbores testis plantatas, sed magno pretio spicam emunt. *Forskohl, quod confirmat Thunberg.*

"Observatio

"Huius gereris forte plures species vel varietates, quarum figuras habent Rumphius & Rheede."

DESCRIPTION OF STANDARD SPECIMEN (Ceylon, *St. John* 24,212): Small tree, 5–7 m tall, 15 cm in diameter; trunk several times branched, forming a broad crown; bark brown, short spiny; leafy branchlets 25 mm in diameter, with numerous sharp conic spines; prop roots 50–80 cm long, 3–5 cm in diameter; leaves 88–95 cm long, 4.6–5 cm wide near the base, 4.3–5.2 cm wide just below the middle, 3.5–4.3 cm wide at the middle, coriaceous, V-sulcate, 2-pleated, shiny green above, pale green and glaucous below, at midsection with 36–37 parallel secondary veins in each half, the tertiary cross veins barely visible above toward the base, forming short oblong meshes, narrowly lance-sword-shaped, tapering from below the middle to the trigonous slender subulate apex, this at the point 10 cm down 1.5 mm wide, the base unarmed, pale, beginning at about 3 cm the margins with spines 5–8 mm long, 17–33 mm apart, subarcuate stout subulate, compressed, ascending, stramineous; beginning at about 4 cm the midrib with prickles 3.5–6 mm long, 10–21 mm apart, arcuate stout subulate, strongly reflexed, stramineous; at midsection the margins with spines 4–9 mm long, 14–23 mm apart, arcuate stout subulate, compressed, strongly ascending, stramineous; the nearby midrib below with prickles 2.5–4 mm long, 16–23 mm apart, subulate from a stout base, mostly reflexed and bent at right angles, stramineous; infructescence terminal, bearing a solitary syncarp; peduncle 21 cm long, 1 cm in diameter, 3-sided, clavate, leafy bracted; syncarp 13 cm long, 9 cm in diameter, ellipsoid; phalanges 4–4.5 cm long, 2.2–3.1 cm wide, 2–2.5 cm thick, cuneate obovoid, 5–6-angled, a little compressed, the lower part cuneiform, orange, the sides flat, not fleshy enlarged, the upper $\frac{4}{7}$ free, red carmine, its sides smooth, shining, gently convex, without secondary angles; carpels 7–10, radial; marginal carpel apices pyramidal hemispheric, without a concave platform; stigmas 2.5–2.8 mm long or wide, broadly elliptic to reniform, apical, elevated, oblique, brown pappillose, some of them truncate; proximal sinuses a hole or a crack extending one-eighth to halfway down from the stigma; central carpel apices $\frac{1}{3}$–$\frac{3}{4}$ as large as the marginal ones, similar but quite symmetric; central apical sinuses 3–4.5 mm deep, nearly straight, V-shaped; endocarp in the upper $\frac{3}{7}$ and 17 mm long, bony, reddish black, oblate spherical, the base concave, the apex low convex, with a lanceoloid projection over each seed, the shoulders lacking, the lateral walls 1.5–2 mm thick, within darkish mahogany red, smooth, shining; seeds 10 mm long, ellipsoid; mesocarp forming in the apex of each carpel a cavern 9–13 mm long, with aerenchyma of a few longitudinal fibers and white membranes; basal mesocarp 14–18 mm long, fibrous and fleshy.

LECTOTYPE: Zeylona, staminate, Dr. *Thunberg* (LINN).

STANDARD SPECIMEN: Ceylon, 25 miles south of Colombo, sandy flat above sea beach, 15 November 1950, *H. St. John* 24,212 (BISH).

DISCUSSION: Linnaeus filius in 1781 described this first valid species of the genus

Pandanus, basing it upon five pre-Linnaean references, one of them from Ceylon, and on a specimen from Ceylon collected by Thunberg. It is not certain that Thunberg collected both staminate and pistillate specimens, but there was available a good illustration of the fruit by Hermann. Of the Thunberg collection, there exists now only a staminate flowering specimen, and this, in the Linnaean Herbarium, is here designated as the lectotype, and the references to Rheede, Rumphius, Forskal, and the Forsters are excluded, as representing other species, and not known to Linnaeus filius by actual specimens. Upon a nomenclatural basis, this completes the necessary legal action. Since there is an existing lectotype, one cannot choose a neotype. However, diagnostic specific characters are not found in staminate specimens of the section *Pandanus*. As a basis for reference and comparison, there is presented here a description and illustration of a standard specimen, complete with fruit. This collection, *St. John* 24,212, was gathered on the shore between Colombo and Galle, not far from where Thunberg gathered the lectotype. Only one species occurs in this littoral zone on Ceylon; consequently, it is considered definite that the lectotype and the standard specimen both represent the same species, *P. odoratissimus*. This species is restricted to Ceylon.

Stone published (1967:243) his concept of the nature and distribution of *Pandanus odoratissimus*, saying, "*Pandanus odoratissimus* owes a number of its synonyms and in general much of the confusion surrounding the species is also due to the ephemeral nature of one of the major characteristics of the species, namely the abrupt fleshy dark red shoulders of the mature phalanges.... The other major character is the nature of the large, white spines of the leaves. By itself, this feature of armature must have seemed of secondary importance to earlier botanists; yet in conjunction with the fleshy shoulders, it is the hallmark of the species. *Neither character is found in the Pacific Islands beyond Malaysia.*" On an earlier page (1967:238) he gave a detailed description of *P. odoratissimus*, sensu Stone, and there he is more precise about the leaf prickles, as follows, "Prickles *white*, or the extreme tip dark, commonly 3–5 mm long, often longer; in some forms up to 10 mm long, slender, very sharp, very slightly curved; prickles of margins all forwardly directed; prickles of midrib forwardly directed in the distal half (approximately) of the leaf, but the prickles of the proximal part retrorse. Spacing of the prickles rather irregular, but distally the prickles always smaller and more crowded, proximally always larger and farther apart; commonly (near the leaf base) the prickles 1–3 cm apart. (Some forms probably for genetic reasons unarmed.)"

So, Stone proposes (1967:233, 243) delimiting *Pandanus odoratissimus* by just two characters: fleshy shoulders on the phalanges and large white spines on the leaves. Concerning the shoulders, he says, "Immature fruits, even when seen in the field, lack these; dried fruits, even when collected fully mature, also lack them (due to shrinkage); and many field collected fruits lack them from depredations of ants or other insects. Consequently, this character, so effective in defining *P. odoratissimus*, has either been missed or ignored by most previous authorities." It is agreed that phalanges that are old and weathered from long exposure, and ones chewed upon by animals, lose this fleshy shoulder character. On the contrary, ripe phalanges of this sort show the shoulders conspicuously. While still fixed to the core, the shoulders force the phalanges far apart. When dried, almost always there is a trace of the shoulder persisting, as a hard inverted bracket at the top of the shoulder where it emerges from the lower mesocarp. Hence, the writer agrees that the presence of fleshy shoulders on the phalanges is a good and a practical character. It was apparently first noticed and used by Martelli (1908:65–66) when he described. *P. coronatus* from Mindanao in the Philippines.

Depending solely on his criteria of the fleshy shoulders and large white spines, Stone (1967:237), in his eagerness for lumping, has reduced to the synonymy of

Pandanus odoratissimus the following sum of species described by the writer: from Malaya, 8; from Anamba Islands, 1; from Vietnam, 9; from Hong Kong, 1; and from the Maldive Islands, 4. Of these species, when based on the author's own collections and described as with fleshy shoulders, Stone accepts them, but when the author described and figured them as lacking shoulders, Stone (1967:244–251) calls them immature, or questions the author's description and illustration. His action seems based on prejudice, not on scientific judgment. Of *P. hueensis* St. John, for instance, the author found good ripe material, collected an entire mature syncarp, and while fresh, on the same day, made a careful drawing of the phalanges. This species does not have fleshy shoulders. The writer at the time was fully aware of the importance of the fleshy shoulder character, and had already observed it in the field in Hong Kong and in Okinawa.

Pandanus odoratissimus as defined by Stone (1967:236) has an eastern limit "in the general vicinity of Wallace's Line." The writer's observations are contrary to this limit for *Pandanus* plants with fleshy shoulders or large white spines. For instance, *P. subconvexus* St. John, based on *Stone* 2,585 from Buka, Solomon Islands, has near basal marginal leaf prickles 4–6 mm long and 7–20 mm apart. Eastern species with fleshy distended shoulders on the syncarps include: *P. mulleolus* St. John, from Merauke, Indonesian New Guinea, based on *St. John* 26,148; *P. crassus* St. John, from Timoe Atoll, Tuamotu Archipelago, based on *St. John & Fosberg* 15,218; and *P. taravaiensis* St. John, from Taravai Island, Gambier Islands, based on *St. John* 14,806.

In conclusion, the new definition of *P. odoratissimus* L.f., based on *St. John* 24,212 from Ceylon, has large leaf spines, but does not have fleshy shoulders on the phalanges. This is confirmed by the author's drawings, by his memory, and by several Kodachrome slides showing ripe syncarps and separated ripe phalanges. Other specimens observed on the coast of Ceylon were of the same character.

For the kinds of littoral *Pandanus* on the shores of the Philippines, Melanesia, Australia, and Polynesia, Stone (1976:60–67) adopts the binomial *P. tectorius* Parkins. ex Z, and lengthily argues that most are to be included in the *tectorius* complex. In the Pacific he admits a very few other distinct species: *P. Reineckei* of Samoa, *P. kusaicola* of Kusaie, and *P. boninensis* of the Bonin Islands. He implies that for the vast expanse of the tropical Pacific, there is but a single species, *P. tectorius*. Then, in particular, he treats the group in the New Hebrides, and recognizes it as represented there by nine varieties of *P. tectorius*.

Stone suggests (1976:64) that when a neotype is chosen for *P. tectorius*, it may well be identical with one of the published varieties. That, however, is not nomenclaturally legal. A specimen from Tahiti, collected by Banks and Solander, is now made the lectotype of the species. Since there exists a lectotype, one cannot choose a neotype.

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